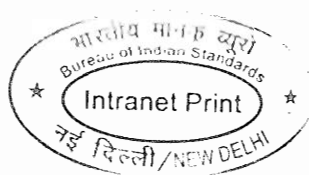


IS : 5798 - 1970
Reaffirmed - 2012

Indian Standard
SPECIFICATION FOR
MERCURY BAROMETERS

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**AMENDMENT NO. 1 AUGUST 2002
TO
IS 5798 : 1970 SPECIFICATION FOR MERCURY
BAROMETERS**

Substitute 'hecta Pascal (hPa)' for 'millibar (mb)' wherever appears.

(BP 21)

Reprography Unit, BIS, New Delhi, India

IS : 5798 - 1970

Indian Standard
SPECIFICATION FOR
MERCURY BAROMETERS

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Indian Standard
SPECIFICATION FOR
MERCURY BAROMETERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 4 September 1970, after the draft finalized by the Meteorological Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Atmospheric pressure is generally measured by means of either a mercury or an aneroid barometer. The Kew pattern or fixed cistern type mercury barometer is commonly used in India for meteorological measurements due to the many advantages it has over the older conventional Fortin's type barometer. The requirements of aneroid barometer are covered in IS : 5793-1970*.

0.3 Specifications for fixed cistern barometers used at land stations and on board ships have been prepared by the India Meteorological Department, but no Indian Standards for these exist. With the increasing requirements in the country for these instruments, the formulation of an Indian Standard for barometers and their test and certification by ISI has become necessary.

0.4 This standard has been prepared in the interests of standardization of fixed cistern mercury barometers and the accurate measurement of atmospheric pressure for meteorological purposes. The test and examination of all mercury and aneroid barometers and their initial certification after manufacture shall in future be the sole responsibility of ISI.

0.5 In the formulation of this standard, due consideration has been given to the requirements laid down by the World Meteorological Organization, Geneva, as well as the special circumstances obtaining in the country.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Specification for aneroid barometers.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the requirements of fixed cistern mercury barometers suitable for use both on land and on board ships.

2. DESCRIPTION

2.1 The basic principle of the mercury barometer is that the pressure of the atmosphere is balanced against the weight of a column of mercury, the height of the column being taken as a measure of the pressure. The essential part of the Kew pattern barometer consists of a vertical glass tube of known uniform diameter in which the barometric column is supported, a cistern of fixed known diameter to contain the mercury and a specially contracted scale with which to measure the height of the column. Since the weight of the mercury column depends on its density, which is a function of its temperature, an attached thermometer is a necessary adjunct to the instrument. Because the variations in the height of the mercury column is accompanied by changes in the level of mercury in the cistern, the scale is graduated in contracted units to avoid a computation after each reading. For the majority of the barometers, the diameter of the tube and cistern are 8 and 50 mm respectively, giving a scale contraction value of approximately 0.975. It is possible to read the pressure on the barometer correct to 0.1 mb by means of a vernier attachment.

2.2 The marine barometer used on board ships and the station barometer used at land stations are similar in all respects except that the bore of the glass tube of the marine barometer is constricted to a fine capillary for the greater part of its length to reduce 'pumping' action due to the ship's motion. The station barometer is mounted on a backboard and is so suspended that it hangs vertically and the cistern is held in position in a clamping ring by three screws. The marine barometer is always swung in gimbals and is supported by a long suspension arm to allow room for the barometer to swing with the movement of the ship and always remain vertical. The arm is either screwed to a bulk head or slipped into a socket screwed to a bulk head. The barometer may be provided with a special correction slide for computing the corrections instead of an attached thermometer.

2.3 The station barometer is made to have three different ranges to suit stations having different elevations above sea level. The ship's barometer has only one range and is adjusted like the station barometer to read correctly when it is at 0°C and subject to an acceleration due to gravity of 980.665 cm/s^2 assuming the density of mercury at 0°C to be 13.5951 gm/cm^3 .

3. TYPES

3.1 The barometers shall be of the following two types:

- a) Station barometer for use at land stations (see Fig. 1), and
- b) Marine barometer for use on board ships.

IS : 5798 - 1970

3.1.1 The station barometer shall have the following three ranges to suit the elevations of different stations:

- a) Short range, graduated from 870 to 1 100 millibar;
- b) Medium range, graduated from 680 to 1 060 millibar; and
- c) Long range, graduated from 500 to 1 060 millibar.

3.1.2 The marine barometer shall have a range of 870 to 1 100 millibar.

4. MATERIAL

4.1 The glass tube shall be of the best lead glass and thoroughly annealed. The glass shall be perfectly clear and dry. The glass cover for the scale shall be clear and of good quality.

4.2 The cistern, its cover and the gland shall be of stainless steel.

4.3 The mercury used in the barometer shall be of a high order of purity suitable for use as an analytical reagent with a specific gravity of 13.595 1 g/cm³ at 0°C. It shall be triple distilled and give a definitely convex surface to the meniscus in the glass tube both during periods of rising and falling pressures.

4.4 The rest of the components shall be made from good quality brass.

4.5 The backboard for the station barometer shall be of seasoned teak wood and the box of deal wood. The reflector shall be either milk white or opal glass or plain acrylic sheet.

5. DIMENSIONS

5.1 The barometers shall have the main dimensions given in Table 1. For nomenclature, see Fig. 1.

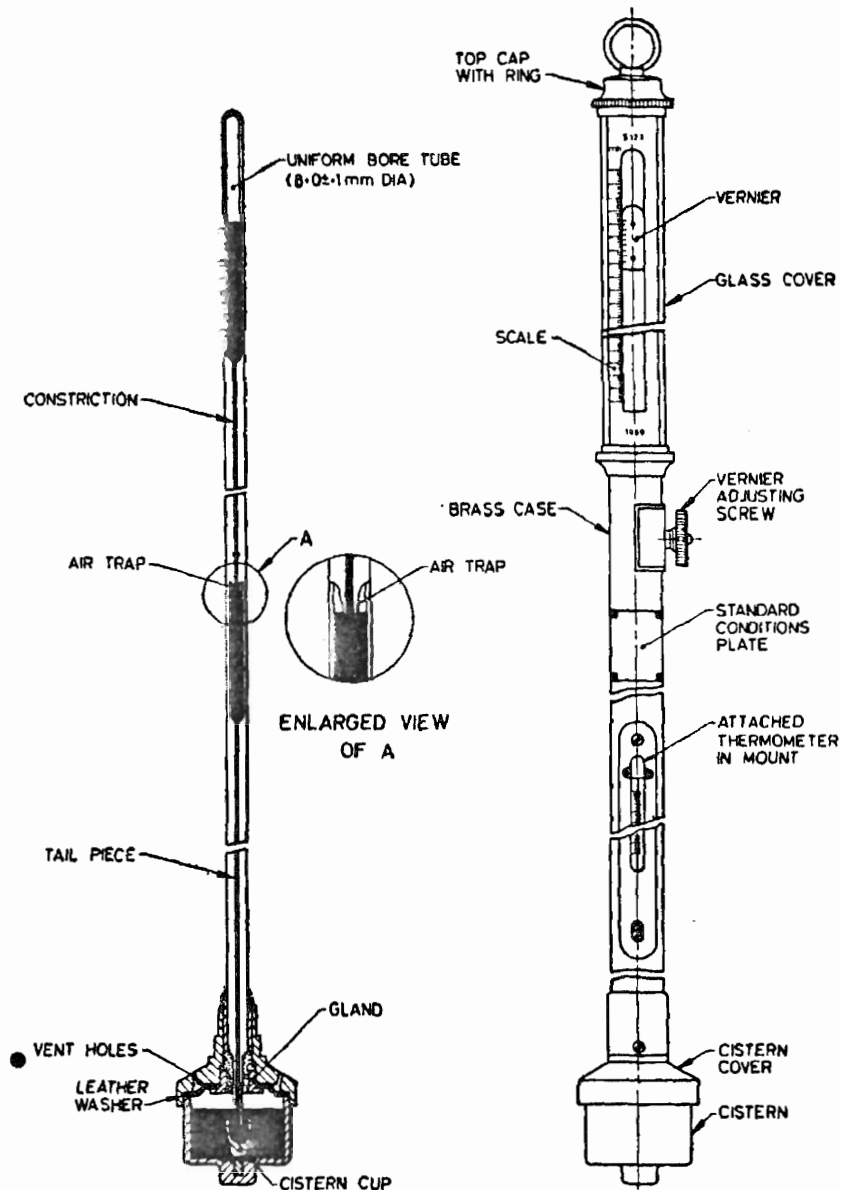
6. GENERAL REQUIREMENTS

6.1 Station Barometer

6.1.1 The barometer tube shall be filled with pure dry mercury under high vacuum such that the meniscus is convex at all times. The tube should also be heated and cooled under vacuum to remove absorbed gases.

6.1.2 An air trap approximately 45 mm long shall be provided in the tube for trapping air bubbles which may enter at the bottom of the tube as shown in Fig. 1.

6.1.3 The glass tube shall be fitted to the steel cistern by means of a supporting unit incorporating the cistern cover and a gland. The joint between the tube and the cistern cover shall be firm and tight. The tube



IA Cistern and Tube of Barometer IB Brass Case and Scale of Barometer
FIG. 1 NOMENCLATURE FOR MERCURY BAROMETER

TABLE 1 MAIN DIMENSIONS OF MERCURY KEW PATTERN BAROMETERS

SL No.	DETAIL	SHORT RANGE	MEDIUM RANGE	LONG RANGE	MARINE
(1)	(2)	(3)	(4)	(5)	(6)
1	Range of the scale (mb)	870-1 100	680-1 060	500-1 060	870-1 100
2	Diameter of the part of the tube having uniform bore (mm)	8±0.1	8±0.1	8±0.1	8±0.1
3	Diameter of capillary portion of tube (mm), <i>Min</i>	1.6	1.6	1.6	0.4
4	Internal diameter of the cistern (mm)	50 ± 0.25	50 ± 0.25	50 ± 0.25	50 ± 0.25
5	Clear internal depth of cistern (mm)	35	50	65	35
6	Overall length of tube (mm)	870	850	860	870
7	Length of the portion of the tube having uniform bore (mm)	240	380	500	240
8	Diameter of tip of tube dipping in mercury in cistern (mm)	6	6	6	6
9	Length of tip of tube dipping in mercury in cistern (mm)	32	42	50	32
10	Diameter of brass case (mm)	25	25	25	25
11	Length of glass shade (mm)	230 ± 1	330 ± 1	460 ± 1	230 ± 1
12	Diameter of glass shade (mm), <i>Min</i>	28	28	28	28
13	Thickness of glass shade (mm), approximately	1.5	1.5	1.5	1.5

shall be supported in the brass case at the top and also about half way along its length.

6.1.4 The inside surface of the cistern shall be well-polished to a depth pf at least 25 mm.

6.1.5 The cistern shall be screwed to the cover as shown against a leather washer. Two vent holes shall be provided in the cistern cover to allow passage of air into the space above the mercury in the cistern through the leather washer.

6.1.6 The tube, cistern and cover shall have dimensions such that all the mercury drained from the upper portion of the tube may be accommodated in the cistern with no risk of the tip of the tube being exposed above the mercury in the cistern when the mercury in the tube is pushed up to its closed end.

6.1.7 The scale engraved on the brass case shall be in whole millibars such that it denotes the correct pressure when the temperature of the barometer is 0°C and subject to an acceleration due to gravity of 980.665 cm/s^2 assuming that the density of mercury at 0°C is 13.5951 g/cm^3 . The scale shall be figured every 10 mb. The length of the scale graduations shall be 5 mm for tens, 4 mm for fives and 3 mm for each millibar unit.

6.1.8 Two parallel slots shall be provided in the brass case to carry one vernier for the short and medium range barometers and two for the long range model. The vernier shall be mounted on a vernier carrier and moved by means of a rack and pinion operated by a milled head adjusting screw. The operation of the rack and pinion shall be smooth with no backlash.

6.1.9 A glass cover shall be provided around the scale for its protection.

6.1.10 Ten vernier divisions shall cover 39 millibar divisions on the scale to give an accuracy of reading of 0.1 mb to the barometer.

6.1.11 A thermometer suitably protected by a mount and having a range from -20° to $+50^{\circ}\text{C}$ with an accuracy of 0.2°C shall be fixed to the brass case in front. The mount shall also have graduations for every 5°C and be figured every 10°C to correspond to the graduations on the thermometer.

6.1.12 The station barometer shall be provided with a suitable wooden backboard having a metal suspension hook at the top from which the barometer may be suspended, and a ring with three radial screws at the bottom for clamping the barometer cistern. A suitable milk white sheet shall be screwed on the backboard to serve as a good background for easy and accurate setting of the vernier. The backboard shall have two fixing plates for suspending it from a suitable support. Alternately the barometer shall be provided with a short hinged arm fixed to gimbal rings on the brass case for vertical suspension.

6.1.12.1 The backboard shall be of good quality teak 120 mm wide, 20 mm thick and overall lengths of 915, 890 and 900 mm for short, medium and long barometers. The marine barometer backboard shall be similar to that of the short barometer.

IS : 5798 - 1970

6.1.13 The box for the barometer shall have a hinged lid and lock and shall have an internal cross section of 80 mm × 80 mm. It shall have rubber ring packings and end buffers of soft rubber fitted inside. A strong handle shall be fixed on the lid for carrying the barometer with the cistern end up. A wooden support shall be fixed at one end at the bottom to enable the box to be placed on a level surface with the cistern end at a higher level. The internal dimensions of the box shall be 990 × 80 × 80 mm.

6.2 Marine Barometers — The marine barometer is similar in all respects to the short range station type barometer except for the following.

6.2.1 About 10 cm of the length of the capillary portion of the tube shall be of a fine bore of about 0.4 mm diameter.

6.2.2 Each marine barometer may be provided with a gold barometer correction slide with thermometer instead of an attached thermometer in mount. The slide helps in the reduction of the barometer reading for conditions of standard temperature and gravity and to mean sea level.

6.2.3 The marine barometer shall have a gimbal ring fixed on the case below the vernier adjusting screw to enable the barometer to maintain verticality at all times.

6.2.4 A stout and strong suspension arm shall fit into the gimbal ring to enable the barometer to be suspended from it. The suspension arm shall be hinged to permit 'harbour stowage' and all the suspension arms shall be interchangeable.

7. WORKMANSHIP AND FINISH

7.1 The stainless steel cistern and cover shall be polished bright.

7.2 The barometer scale, vernier and the thermometer scale shall be silvered, engraved with fine black lines of uniform thickness and depth throughout and lacquered with colourless lacquer.

7.3 The brass case and suspension arm shall be protected with one coat of cellulose primer and three coats of black matt cellulose lacquer.

7.4 All other brass fittings shall be polished and gold lacquered.

7.5 The backboard and box shall be finished smooth and polished.

8. TESTS AND ACCURACY

8.1 When calibrated in a suitably designed and operated vacuum chamber against a standard barometer whose errors are known and allowed for, the maximum permissible error at 1 000 mb shall not exceed ±0.3 mb; for marine barometers the limit shall be ±0.5 mb.

8.2 The maximum permissible error at any other pressure for the short range station barometer and the marine barometer shall be ± 0.5 mb; for the medium and long range station barometers the limit shall be ± 0.8 mb.

8.3 The difference between errors over an interval of 100 mb or less shall not exceed 0.3 mb.

8.4 In the marine barometer, the time taken by the mercury column to fall from 50 mb to 18 mb above the equilibrium position shall be within 6 to 9 minutes.

8.5 When the station barometer is inclined gently to push the mercury in the tube to the top of the tube, a fine metallic 'click' shall be clearly audible when the mercury hits the top of the tube.

8.6 The meniscus of the mercury shall be convex at all times.

9. MARKING

9.1 All mercury barometers shall have a plate fixed on the case with the following inscription engraved on it:

STANDARD CONDITIONS
TEMPERATURE 0°C
 $g = 980.665 \text{ cm/s}^2$

9.2 Above the highest graduation mark on the scale, the unit symbol 'mb' shall be engraved.

9.3 The letter 'S' or 'M' to indicate that the barometer is a station or marine type respectively and the serial number shall be engraved at the top of the scale and the year of manufacture at the bottom of the scale on the brass case.

9.3.1 The barometers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. Presence of this mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

IS : 5798 - 1970

10. PACKING

10.1 The barometers shall be packed for transport in a special deal wood box with a locking arrangement. The rubber rings and end buffers in the wooden box shall give the necessary cushioning effect for the barometers such that they stand normal transport risks under escort. The barometer backboard with top hook and bottom ring shall also be packed in suitable deal wood box.

11. TESTING AND INSPECTION

11.1 Each barometer shall be tested individually for conformity to all the requirements of this specification.

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